Ali Arshad Uppal, Ph.D., SMIEEE

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Research Interests

• Nonlinear control • Optimal control • Data driven control • Control of energy conversion systems

Professional Experience

2023 – · · · · **Tenured Associate Professor,** Department of Electrical & Computer Engineering, COMSATS University Islamabad (CUI), Islamabad, Pakistan

- Teaching at graduate & undergraduate levels
- Supervision/Co-supervision of MS and Ph.D. theses and undergraduate projects
- Head of Control and Energy Systems Research group

2014 – 2023 **Assistant Professor,** Department of Electrical & Computer Engineering, CUI

- Teaching at graduate & undergraduate levels
- Supervision/Co-supervision of MS and Ph.D. theses and undergraduate projects
- Head of Control and Energy Systems Research group

2020 – 2021 **Doctoral Researcher,** Department of Electrical & Computer Engineering, University of Porto, Porto, Portugal
Research Project: *FCT UPWIND– A Multi-Kite System to Harvest High Altitude Wind Power*

- Modelling and parametrization of the induction machine (IM)
- Development of observer based rotor flux-oriented control of the IM
- Development of a robust cascade control of the ground station module of the airborne wind energy system (AWES) in all operational phases
- Development of the supervisory controller for the AWES

2015 – 2016 **Visiting Scholar,** Department of Electrical & Computer Engineering, The Ohio State University, Columbus, OH, USA

- Development of a simplified time domain model of underground coal gaisification (UCG) process
- Development of the model based control of the UCG process based on Sliding Mode Control theory
- Implementation of the developed controller on the actual process model
- The stability of the zero dynamics, which guarantees the overall stability of the closed loop system

2012 – 2014 **Professional Researcher,** Control & Signal Processing Research Group, Capital University of Science & technology, Islamabad, Pakistan
Research Project: *ICT R & D Funds– Simulation and Control of the UCG* process

- Development of the one-dimensional packed bed reactor model for Thar gasifier
- Numerical solution of the developed model
- Computer simulation of the numerical solution techniques
- Parameter estimation for the UCG process
- Model validation with actual field trials
- Robust control system design for obtaining a desired calorific value of the product gas mixture

Professional Experience (continued)

2008 – 2012 **Lecturer,** Department of Electrical & Computer Engineering, CUI

- Teaching at undergraduate level
- Supervision of undergraduate projects
- Designed and conducted labs for Electric Machines and Control System

2007 – 2008 **Design Engineer,** Public Sector Organization, Islamabad, Pakistan

- Integration and testing of electronic modules

Education

2012 – 2016 **Ph.D., Electrical Engineering, COMSATS University Islamabad.**
Thesis title: Modeling and Control of Underground Coal Gasification.

2009 – 2011 **M.Sc., Computer Engineering, University of Engineering & Technology Taxila.**
Thesis title: Dynamic Modeling and Nonlinear Controller Design for UCG.

2003 – 2006 **BS., Electrical Engineering, University of Engineering & Technology Taxila.**

Publications

Journal Articles

1. A. Ahmed, **A. A. Uppal**, and Q. Ahmed, "Electric vehicle range maximization using mpc based active battery cell balancing **(under review)**," *IEEE Transactions on Control Systems Technology*, May 2024.
2. Y. CW., S. Riaz, **A. A. Uppal**, and J. Iqbal, "Fuzzy fault-tolerant controller with guaranteed performance for mimo systems under uncertain initial state," *International Journal of Control, Automation and Systems*, vol. 22, pp. 2038–2054, Jun. 2024. DOI: 10.1007/s12555-023-0327-5.
3. S. B. Javed, **A. A. Uppal**, M. R. Azam, and Q. Ahmed, "Model-based quantitative analysis of power losses aware active cell balancing networks with load **(under review)**," *IEEE Transactions on Transportation and Electrification*, Apr. 2024.
4. S. Ahmad, **A. A. Uppal**, M. R. Azam, and J. Iqbal, "Chattering free sliding mode control and state dependent kalman filter design for underground gasification energy conversion process," *Electronics*, vol. 12, no. 4, Feb. 2023, ISSN: 2079-9292. DOI: 10.3390/electronics12040876.
5. A. Ahmed, S. B. Javed, **A. A. Uppal**, and J. Iqbal, "Development of cavlab–a control-oriented matlab based simulator for an underground coal gasification process," *Mathematics*, vol. 11, no. 11, May 2023, ISSN: 2227-7390. DOI: 10.3390/math11112493.
6. A. Ahmed, **A. A. Uppal**, and S. B. Javed, "Nonlinear-control-oriented modeling of the multi-variable underground coal gasification process for ucg project thar: A machine learning perspective," *Journal of Process Control*, vol. 131, p. 103 090, Nov. 2023, ISSN: 0959-1524. DOI: 10.1016/j.jprocont.2023.103090.
7. U. Javaid, A. Mehmood, J. Iqbal, and **A. A. Uppal**, "Neural network and ured observer based fast terminal integral sliding mode control for energy efficient polymer electrolyte membrane fuel cell used in vehicular technologies," *Energy*, vol. 269, p. 126 717, 2023, ISSN: 0360-5442. DOI: 10.1016/j.energy.2023.126717.
8. **A. A. Uppal**, M. R. Azam, and J. Iqbal, "Sliding mode control in dynamic systems," *Electronics*, vol. 12, no. 13, Jul. 2023. DOI: 10.3390/electronics12132970.
9. **A. A. Uppal**, S. B. Javed, and Q. Ahmed, "Power losses aware nonlinear model predictive control design for active cell balancing," *IEEE Control Systems Letters*, vol. 7, pp. 3705–3710, Dec. 2023. DOI: 10.1109/LCSYS.2023.3342550.
10. S. Bano, M. R. Azam, **A. A. Uppal**, S. B. Javed, and A. I. Bhatti, "Robust p53 recovery using chattering free sliding mode control and a gain-scheduled modified utkin observer," *Journal of Theoretical Biology*, vol. 532, p. 110 914, 2022, ISSN: 0022-5193. DOI: 10.1016/j.jtbi.2021.110914.

11 U. Javaid, J. Iqbal, A. Mehmood, and **A. A. Uppal**, "Performance improvement in polymer electrolytic membrane fuel cell based on nonlinear control strategies—a comprehensive study," *PLOS ONE*, vol. 17, no. 2, pp. 1–20, Feb. 2022. DOI: 10.1371/journal.pone.0264205.

12 S. B. Javed, V. I. Utkin, **A. A. Uppal**, R. Samar, and A. I. Bhatti, "Data-driven modeling and design of multivariable dynamic sliding mode control for the underground coal gasification project thar," *IEEE Transactions on Control Systems Technology*, vol. 30, no. 1, pp. 153–165, 2022. DOI: 10.1109/TCST.2021.3057633.

13 M. Khattak, **A. A. Uppal**, Q. Khan, *et al.*, "Neuro-adaptive sliding mode control for underground coal gasification energy conversion process," *International Journal of Control*, vol. 95, no. 9, pp. 2337–2348, 2022. DOI: 10.1080/00207179.2021.1909745.

14 H. Muazzam, M. K. Ishak, A. Hanif, **A. A. Uppal**, A. Bhatti, and N. A. M. Isa, "Virtual sensor using a super twisting algorithm based uniform robust exact differentiator for electric vehicles," *Energies*, vol. 15, no. 5, 2022. DOI: 10.3390/en15051773.

15 I. U. Rehman, S. B. Javed, A. M. Chaudhry, M. R. Azam, and **A. A. Uppal**, "Model-based dynamic sliding mode control and adaptive kalman filter design for boiler-turbine energy conversion system," *Journal of Process Control*, vol. 116, pp. 221–233, 2022, ISSN: 0959-1524. DOI: 10.1016/j.jprocont.2022.06.006.

16 Y. M. Alsmadi, I. U. Rehman, **A. A. Uppal**, V. Utkin, I. Chairez, and M. Ibbini, "Super-twisting-based sliding mode control of drum boiler energy conversion systems," *International Journal of Control*, vol. 95, no. 7, pp. 1888–1897, 2021. DOI: 10.1080/00207179.2021.1884293.

17 A. M. Chaudhry, **A. A. Uppal**, and S. Bram, "Model predictive control and adaptive kalman filter design for an underground coal gasification process," *IEEE Access*, vol. 9, pp. 130 737–130 750, 2021. DOI: 10.1109/ACCESS.2021.3114260.

18 S. B. Javed, **A. A. Uppal**, R. Samar, and A. I. Bhatti, "Design and implementation of multi-variable H_∞ robust control for the underground coal gasification project thar," *Energy*, vol. 216, p. 119 000, 2021, ISSN: 0360-5442. DOI: 10.1016/j.energy.2020.119000.

19 A. Mohsin, Y. Alsmadi, **A. A. Uppal**, and S. M. Gulfam, "A modified simplex based direct search optimization algorithm for adaptive transversal fir filters," *Science Progress*, vol. 104, no. 2, p. 00 368 504 211 025 409, 2021. DOI: 10.1177/00368504211025409.

20 M. Riaz, A. R. Yasin, **A. A. Uppal**, and A. Yasin, "A novel dynamic integral sliding mode control for power electronic converters," *Science Progress*, vol. 104, no. 4, p. 00 368 504 211 044 848, 2021. DOI: 10.1177/00368504211044848.

21 **A. A. Uppal**, M. C. R. M. Fernandes, S. Vinha, and F. A. C. C. Fontes, "Cascade control of the ground station module of an airborne wind energy system," *Energies*, vol. 14, no. 24, 2021, ISSN: 1996-1073. DOI: 10.3390/en14248337.

22 A. M. Chaudhry, **A. A. Uppal**, Y. M. Alsmadi, A. I. Bhatti, and V. I. Utkin, "Robust multi-objective control design for underground coal gasification energy conversion process," *International Journal of Control*, vol. 93, no. 2, pp. 328–335, 2020. DOI: 10.1080/00207179.2018.1516893.

23 M. Ilyas, J. Iqbal, S. Ahmad, **A. A. Uppal**, W. A. Imtiaz, and R. A. Riaz, "Hypnosis regulation in propofol anaesthesia employing super-twisting sliding mode control to compensate variability dynamics," *IET Systems Biology*, vol. 14, no. 2, pp. 59–67, 2020. DOI: 10.1049/iet-syb.2018.5080.

24 Q. Irum, S. A. Khan, **A. A. Uppal**, and L. Krivodonova, "Galerkin finite element based modeling of one dimensional packed bed reactor for underground coal gasification (ucg) process," *IEEE Access*, vol. 8, pp. 223 130–223 139, 2020. DOI: 10.1109/ACCESS.2020.3044194.

25 U. Javaid, A. Mehmood, A. Arshad, F. Imtiaz, and J. Iqbal, "Operational efficiency improvement of pem fuel cell—a sliding mode based modern control approach," *IEEE Access*, vol. 8, pp. 95 823–95 831, 2020. DOI: 10.1109/ACCESS.2020.2995895.

26 Y. M. Alsmadi, A. M. Abdel-hamed, A. E. Ellissy, *et al.*, "Optimal configuration and energy management scheme of an isolated micro-grid using cuckoo search optimization algorithm," *Journal of the Franklin Institute*, vol. 356, no. 8, pp. 4191–4214, 2019, ISSN: 0016-0032. DOI: 10.1016/j.jfranklin.2018.12.014.

27. S. B. Javed, **A. A. Uppal**, A. I. Bhatti, and R. Samar, "Prediction and parametric analysis of cavity growth for the underground coal gasification project thar," *Energy*, vol. 172, pp. 1277–1290, 2019, ISSN: 0360-5442. DOI: 10.1016/j.energy.2019.02.005.

28. M. Rizwan Azam, V. I. Utkin, A. Arshad Uppal, and A. I. Bhatti, "Sliding mode controller–observer pair for p53 pathway," *IET Systems Biology*, vol. 13, no. 4, pp. 204–211, 2019. DOI: 10.1049/iet-syb.2018.5121.

29. **A. A. Uppal**, S. S. Butt, Q. Khan, and H. Aschemann, "Robust tracking of the heating value in an underground coal gasification process using dynamic integral sliding mode control and a gain scheduled modified utkin observer," *Journal of Process Control*, vol. 73, pp. 113–122, 2019, ISSN: 0959-1524. DOI: 10.1016/j.jprocont.2018.11.005.

30. A. R. Yasin, M. Ashraf, A. I. Bhatti, and **A. A. Uppal**, "Fixed frequency sliding mode control of renewable energy resources in dc micro grid," *Asian Journal of Control*, vol. 21, no. 4, pp. 2074–2086, 2019. DOI: 10.1002/asjc.2057.

31. **A. A. Uppal**, Y. M. Alsmadi, V. I. Utkin, A. I. Bhatti, and S. A. Khan, "Sliding mode control of underground coal gasification energy conversion process," *IEEE Transactions on Control Systems Technology*, vol. 26, no. 2, pp. 587–598, 2018. DOI: 10.1109/TCST.2017.2692718.

32. I. Khan, A. I. Bhatti, **A. A. Uppal**, and Q. Khan, "Robustness and performance parameterization of smooth second order sliding mode control," *International Journal of Control, Automation and Systems*, vol. 14, no. 3, pp. 681–690, Jun. 2016, ISSN: 2005-4092. DOI: 10.1007/s12555-014-0181-6.

33. **A. A. Uppal**, A. I. Bhatti, E. Aamir, R. Samar, and S. A. Khan, "Optimization and control of one dimensional packed bed model of underground coal gasification," *Journal of Process Control*, vol. 35, pp. 11–20, 2015, ISSN: 0959-1524. DOI: 10.1016/j.jprocont.2015.08.002.

34. **A. A. Uppal**, A. I. Bhatti, E. Aamir, R. Samar, and S. A. Khan, "Control oriented modeling and optimization of one dimensional packed bed model of underground coal gasification," *Journal of Process Control*, vol. 24, no. 1, pp. 269–277, 2014, ISSN: 0959-1524. DOI: 10.1016/j.jprocont.2013.12.001.

Conference Proceedings

1. M. R. Azam, A. Ahmed, **A. A. Uppal**, and Q. Ahmed, "Nonlinear model predictive control design for active cell balancing and thermal management (**accepted for presentation**)," in *2024 IEEE Conference on Control Technology and Applications (CCTA)*.

2. **A. A. Uppal**, S. B. Javed, and Q. Ahmed, "Power losses aware nonlinear model predictive control design for active cell balancing (**accepted for presentation**)," in *American Control Conference 2024*.

3. S. B. Javed, **A. A. Uppal**, M. R. Azam, K. Shehzad, and Q. Ahmed, "Model-based quantitative analysis of a capacitive cell balancing technique using soc estimator," in *2022 IEEE Conference on Control Technology and Applications (CCTA)*, 2022, pp. 670–675. DOI: 10.1109/CCTA49430.2022.9966110.

4. **A. A. Uppal**, S. S. Butt, A. I. Bhatti, and H. Aschemann, "Integral sliding mode control and gain-scheduled modified utkin observer for an underground coal gasification energy conversion process," in *2018 23rd International Conference on Methods and Models in Automation and Robotics (MMAR)*, 2018, pp. 357–362. DOI: 10.1109/MMAR.2018.8486053.

5. G. Murtaza, A. I. Bhatti, Q. Ahmed, and **A. A. Uppal**, "Nonlinear robust control of atkinson cycle engine," in *20th IFAC World Congress*, 2017, pp. 3685–3690. DOI: 10.1016/j.ifacol.2017.08.562.

6. M. Azam, A. Bhatti, A. Arshad, and M. Babar, "Sensitivity analysis of wnt signaling pathway," in *Proceedings of 2013 10th International Bhurban Conference on Applied Sciences & Technology (IBCAST)*, 2013, pp. 122–127. DOI: 10.1109/IBCAST.2013.6512143.

7. A. Arshad, A. I. Bhatti, R. Samar, Q. Ahmed, and E. Aamir, "Model development of ucg and calorific value maintenance via sliding mode control," in *2012 International Conference on Emerging Technologies*, 2012, pp. 1–6. DOI: 10.1109/ICET.2012.6375477.

Funded Projects

- **Optimal Control of Active Cell Balancing Network for Lithium-ion Battery Pack**
  Accepted in *NESCOM (RAC), Pakistan, PI: Ali Arshad Uppal, funding amount 0.4 Million PKR.*

- **Design and Development of Intelligent Battery Pack for Range Extension of Electric Scooter**
  Submitted in *PSF-TUBITAK Competitive Research Grant*

Student Supervision

- **MS Students**

1. Mr. Imran Ahmed, COMSATS University Islamabad **(2021–2023)**
   Supervisor: Dr. Rizwan Azam, co-supervisor: **Dr. Ali Arshad Uppal**
2. Mr. Afaq Ahmed, COMSATS University Islamabad **(2021–2023)**
   Supervisor: **Dr. Ali Arshad Uppal** co-supervisor: Dr. Syed Bilal Javed
3. Ms. Sara Sarfraz, COMSATS University Islamabad **(2019–2021)**
   Supervisor: **Dr. Ali Arshad Uppal**, co-supervisor: Dr. Qudrat Khan
4. Ms. Shehar Bano, COMSATS University Islamabad **(2018–2020)**
   supervisor: **Dr. Ali Arshad Uppal**, co-supervisor: Dr. Rizwan Azam
5. Ms. Fajar Mukhtar, COMSATS University Islamabad **(2018–2020)**
   supervisor: **Dr. Ali Arshad Uppal**, co-supervisor: Dr. Syed Bilal Javed
6. Mr. Sohail Ahmed, COMSATS University Islamabad **(2018–2020)**
   Supervisor: **Dr. Ali Arshad Uppal**
7. Mr. Bilal Arif, COMSATS University Islamabad **(2018–2020)**
   Supervisor: prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad Uppal**
8. Mr. Mutahir, COMSATS University Islamabad **(2016–2018)**
   supervisor: prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad Uppal**
9. Mr. Imtiaz Ur Rehman, COMSATS University Islamabad **(2016–2018)**
   Supervisor: prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad Uppal**
10. Mr. Fahad Imtiaz, COMSATS University Islamabad **(2014–2016)**
    Supervisor: Dr. Adeel Mehmood, co-supervisor: **Dr. Ali Arshad Uppal**

- **Ph.D. students**

1. Mr. Muhammad Shakeel, COMSATS University Islamabad **(2019–present)**
   Supervisor: **Dr. Ali Arshad Uppal**
2. Mr. Azmat Ullah, COMSATS University Islamabad **(2019–present)**
   Supervisor: **Dr. Ali Arshad Uppal**, co-supervisor: Dr. Rizwan Azam
3. Dr. Usman Javed, COMSATS University Islamabad **(2016–2023)**
   Supervisor: **Dr. Ali Arshad**, co-supervisor: Dr. Adeel Mehmood
4. Dr. Qudsiya Irum, COMSATS University Islamabad **(2016–2022)**
   Supervisor: Prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad Uppal**
5. Dr. Syed Bilal Javed, Capital University of Science & Technology, Islamabad **(2016–2021)**
   Supervisor: Dr. Raza Samar, co-supervisor: **Dr. Ali Arshad Uppal**

Teaching Experience

Graduate courses at COMSATS University Islamabad

- Intelligent Control Systems (ECI761) in Spring 2022
- Nonlinear Systems and Controls (ECI760) in Fall 2021 and Fall 2022
- Linear Control Systems (ECI660) in Fall 2019
- Linear Systems Theory (ECI665) in Spring (2017, 2018 and 2019) and Fall 2017
- Robust Control Systems (ECI765) in Fall 2018

Undergraduate courses at COMSATS University Islamabad

- Control Systems (EEE325, CPE325) in Fall 2023, Spring 2023, and from 2011–2021
- Electric Machines (EEE371) in Spring 2023, and from 2008–2011
- Electronics-I (EEE231) in Fall 2022

Presentations & Workshops

Presentations

1. **Model Predictive Control Design for Targeted Drug Therapy to Recover p53 in Cancer Treatment**, *in Portuguese Meeting on Optimal Control*, 2021
2. **AI Based Control of Industrial Processes**, *in IEEE 2021 International Conference on Digital Futures and Transformative Technologies, School of Electrical Engineering and Computer Science (SEECS), National University of Science and Techbology (NUST), Islamabad, Pakistan, 2021* ***(Guest speaker)***
3. **Sliding mode control of the underground coal gasification energy conversion process**, *in Symposium on Control Systems, SEECS, NUST 2019* ***(Guest speaker)***
4. **Development of a simplified control-oriented model of the underground coal gasification process**, at Department of Electrical & Computer Engineering, The Ohio State University, Columbus, OH, USA, 2015
5. **Development of a one-dimensional packed bed model of the underground coal gasification process for Thar coal gasifier**, at UCG Project Thar, Tharparkar, Pakistan, 2013

Workshops

1. **LaTeX–The Way of Scientific Writing**, at the department of Electrical and Computer Engineering, COMSATS University Islamabad on 17 October 2022
2. **Typesetting in LaTeX**, at Capital University of Science & Technology, Islamabad on March 13 2018, July 17 2019 and August 5 2021, respectively

Computer Skills

- MATLAB/Simulink
- C++
- Maple
- Mathematica
- LaTeX
- MS Office

Awards & Achievements

2022 **Senior Member IEEE**

2020–2021 **Postdoctoral Scholarship** from FEUP, University of Porto, Portugal

Awards & Achievements (continued)

2015 **International Research Support Initiative Program Scholarship** from higher education commission, Pakistan

2014–2015 **Research Productivity Award** from COMSATS University Islamabad

2012–2013 **Ph.D. Scholarship** from UCG project Thar, Pakistan

2012–2016 **In-house Ph.D. Scholarship** from COMSATS University Islamabad, Pakistan

2010–2011 **MS Scholarship** *from UCG project Thar, Pakistan*

Merit MS Scholarship from Center of Advanced Studies in Engineering, University of Engineering & Technology, Taxila, Pakistan

Community Services

2022–2023 **Guest Editor** in the special issue *Sliding Model Control in Dynamic Systems*, MDPI Electronics.

2016–.... **Academic Reviewer** for the Journal of process control, IEEE Control Systems Letters, IEEE Transactions on (Industrial Informatics, Mechatronics, Transportation & Electrification), International Journal of Hydrogen Energy, Energy Conversion and Management, American Control Conference, IEEE Access, and various journals of MDPI.

References

Name	Dr. Aamer Iqbal Bhatti	**Name**	Dr. Qadeer Ahmed
Position	Professor	**Position**	Assistant Professor
Affiliation	University of Engineering and Technology, Lahore, Pakistan	**Affiliation**	The Ohio State University, Columbus, OH, USA
Email	aib@uet.edu.pk	**Email**	ahmed.358@osu.edu
Name	Dr. Jamshed Iqbal	**Name**	Dr. Fernendo Fontes
Position	Senior Lecturer	**Position**	Associate Professor
Affiliation	University of Hull, Hull, UK	**Affiliation**	University of Porto, Portugal
Email	J.Iqbal@hull.ac.uk	**Email**	faf@fe.up.pt